

PATENT SPECIFICATION

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(54) DEEP HOLE DRILL

(71) We, BLANSON PRECISION CUTTING TOOLS LIMITED, a British Company of Morris Road, Knighton Fields Road East, Leicester, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following Statement:

10 The invention relates to deep hole type drills for the high-speed drilling of deep holes in materials in which the chip readily ruptures. In deep hole drilling waste particles are removed from the workface in a stream of fluid which is usually liquid.

15 The use of liquids to remove the waste particles from the holes is sometimes unsuitable when the workpiece is a material with a high abrasive nature and produces very fine particles of waste materials, and or when the workpiece would be contaminated by liquids for example when the workpiece is cast iron, asbestos or graphite. For such applications the use of a forced air stream to remove the waste is preferred. Such a deep hole drill conventionally comprises a cutting tip, generally of tungsten carbide, mounted on a hollow tubular shank, with a supply tube for the air stream to the workface arranged centrally within the tubular shank. The air stream passes down the supply tube and returns with entrained waste particles assisted by an applied partial vacuum between the supply tube and tubular shank.

35 The invention provides such a deep hole drill having a cutting end comprising a central cutting tip tapering inwardly and forwardly to a point of first attack on or adjacent the central axis of the drill and at least one trepanning cutting tip tapering outwardly and forwardly to a point of first attack on the outer periphery of the cutting circle, the central and trepanning cutting tips together spanning the entire width

of the drill. The or each trepanning tip, being arranged on the periphery of the cutting circle, in use cuts an annular hole in the workpiece. The central core which would otherwise remain is broken up by the central cutting tip.

The opposed tapers of the central and trepanning cutting tips result in the formation of holes of a high degree of straightness and constant hole diameters over considerable cutting depths even with high speed drilling. Good control of cutting can be achieved, for example, for holes 30 inches deep and less than one inch in diameter at an entry rate of 100 inches per minute in graphite.

65 Preferably the trepanning cutting tips are arranged in diametrically opposed pairs, angularly displaced from the plane of the central cutting tip to suit the application in question i.e. diameter and length of hole. For example two trepanning cutting tips may be provided, at opposite sides of the cutting head and each displaced 90° from the plane of the cutting tip.

70 The tips are suitably located in axial slots in the tubular shank and secured by brazing. Preferably the tubular shank is swaged outwardly at its forward end so that its forward end extends the full diameter of the cutting circle but the remainder has a smaller diameter and on some applications may have a shallow spiral groove machined in its outside surface to encourage the clearance of dust and swarf from around the tubular shank so that the shank does not bind in the hole formed by the drill.

80 Especially when the forward end of the tubular shank is swaged outwardly, the attempted extraction of the drill may cause binding of the shank in the hole. There is therefore preferably provided a supply tube within the tubular shank and one or more radial air passage extending from the in-

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terior of the supply tube through the walls of the tubular shank, at a forward portion thereof, for providing an air flow between the shank and a hole drilled in a work-
 5 piece. Such passages may, for example, be formed through the centres of locating studs mounting the supply tube, and if the tubular shank has a spiral groove machined in its outer surface at least one
 10 such passage preferably communicates with the base of the groove.

The cutting tips may be of any suitable cutting material, such as tungsten carbide, high speed steel, stellite or ceramic. They
 15 may each be of one-piece construction or may have a cutting edge formed by an insert of such cutting material.

The drills according to the invention are suitable, for example, for the high speed
 20 drilling of holes through the graphite bricks of high temperature nuclear reactors.

The invention is hereinafter particularly described, by way of example only, with
 25 reference to the drawings of which:

Figure 1 is an axial section through the forward end of a drill according to the invention and an associated workpiece, and

Figure 2 is an end view of the drill,
 30 taken in the direction of the arrow A of Figure 1.

The deep hole drill shown in the drawings, comprises a cutting end 1 mounted in a tubular shank 2 at the rearward end of
 35 which (not shown) is a conventional spindle mounting. A supply tube 3 supplies air under superatmospheric pressure to the cutting end 1 and is located centrally in the tubular shank 2 by means of studs 4.
 40 Each of the three studs at the forward end portion of the shank 2 has a hole 4A drilled through the centre of the stud and through the walls of the tubular shank 2 and the supply tube 3. In use air can thus
 45 pass from the supply tube 3 radially outwardly and along the walls of the tubular shank 2, clearing dust and swarf from a hole being drilled in the workpiece.

The cutting end 1 comprises a central cutting tip 5 and a pair of trepanning cutting tips 6, all made from tungsten carbide. The cutting tips are located in short axial slots in the shank 2 and secured by brazing. The forward end of the shank 2 is
 50 swaged outwards to the full cutting circle at 7. The point of first attack 8 of the central cutting tip 5 is on or near the axis of the drill whereas the point of first attack 9 of each trepanning cutting tip 6 is on the

periphery of the cutting circle.

The point 8 is axially forward of the points 9 to enable the drill to be centred when commencing cutting.

In use compressed air at slightly super-atmospheric pressure is blown down the
 65 supply tube 3 and the air and entrained swarf are removed in the air stream between the tube 3 and shank 2.

WHAT WE CLAIM IS:

1. A deep hole drill having a cutting
 70 end comprising a central cutting tip tapering inwardly and forwardly to a point of first attack on or adjacent the central axis of the drill and at least one trepanning cutting tip tapering outwardly and forwardly
 75 to a point of first attack on the outer periphery of the cutting circle, the central and trepanning cutting tips together spanning the entire width of the drill.

2. A drill according to claim 1, wherein
 80 two trepanning cutting tips are provided at opposite sides of the cutting end and each displaced 90° from the plane of the cutting tip.

3. A drill according to either preceding
 85 claim, wherein the central and trepanning cutting tips are located in axial slots in a tubular shank of the drill and are secured by brazing.

4. A drill according to claim 3, wherein
 90 the external diameter of the tubular shank is less than the diameter of the cutting circle except at its forward end where it is swaged outwardly to the diameter of the cutting circle.

5. A drill according to claim 3 or claim
 95 4, including a supply tube within the tubular shank wherein there are provided one or more radial air passages extending from the interior of the supply tube
 100 through the walls of the tubular shank, at a forward portion thereof.

6. A drill according to claim 5, wherein
 the or each radial air passage communicates with the base of a spiral groove
 105 machined in the outer surface of the tubular shank.

7. A drill according to any preceding
 claim, wherein the cutting tips are made of
 110 tungsten carbide.

8. A deep hole drill substantially as herein described with reference to the drawings.

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